WORKING AGENDA
ARCO SERVICE STATION 0608
AUGUST 18, 1997

A. Site Background

B. MtBE Risk Assessment Method

Tier I GSI package:

a. Assumptions

b. Exposure pathways

c. Representative concentration

C. Risk Assessment Approval Letter

a. ARCO would like a draft letter for review

D. TPPH-g, and Benzene, Concentration Trend Analysis

E. Reduction in Groundwater Monitoring Program

Plume Stability → MtBE issue

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: | Job Identification: | Software: GSI RBCA Spreadsheet
Site Location: | Date Completed: | Version: 1.0.1
Completed By: Pacific

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			20	
IRa.out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	***TRUE***			FALSE	
AAFd	Age adjustment on skin surface area	***TRUE***			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	TRUE	FALSE	FALSE
S.v	Volatilization from Subsurface Soils	TRUE	FALSE	
GW.v	Volatilization from Groundwater	TRUE	FALSE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	TRUE	FALSE	
GW.b	Vapors from Groundwater	TRUE	FALSE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	TRUE	FALSE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	TRUE	FALSE	
S.l	Leaching to Groundwater from all Soils	TRUE	FALSE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		TRUE		TRUE
S	Inhalation receptor (cm)		TRUE		TRUE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	1	
Tier	RBCA Tier	1	

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	2.2E+06	1.0E+06
W	Length of affect. soil parallel to wind (cm)	1.5E+03	1.0E+03
W.gw	Length of affect. soil parallel to groundwater (cm	1.5E+03	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater seepage velocity (cm/yr)	6.6E+03
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil	Definition (Units)	Value
hc	Capillary zone thickness (cm)	5.0E+00
hv	Vadose zone thickness (cm)	3.0E+02
rho	Soil density (g/cm^3)	1.7
foc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	0.38
Lgw	Depth to groundwater (cm)	3.0E+02
Ls	Depth to top of affected subsurface soil (cm)	1.0E+02
Lsubs	Thickness of affected subsurface soils (cm)	2.0E+02
pH	Soil/groundwater pH	6.5

		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

RBCA CHEMICAL DATABASE

Physical Property Data

CAS Number	Constituent	type	Molecular Weight (g/mole) MW	ref	Diffusion Coefficients in air (cm2/s) Dair	ref	in water (cm2/s) Dwat	ref	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	ref	Henry's Law Constant (@ 20 - 25 C) (atm-m3/mol)	(unitless)	ref	Vapor Pressure (@ 20 - 25 C) (mm Hg)	ref	Solubility (@ 20 - 25 C) (mg/L)	ref	acid pKa	base pKb	ref
1634-04-4	Methyl t-Butyl Ether	O	88.146	5	7.92E-02	6	9.41E-05	7	1.08	A	5.77E-04	2.40E-02		2.49E+02		4.80E+04	A			

Site Name: 0 Site Location: 0 Completed By: Pacific Date Completed: 1/1/1904

RBCA CHEMICAL DATABASE

Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	ref	Inhalation RfD_inhal	ref	Slope Factors 1/(mg/kg/day) Oral SF_oral	ref	Inhalation SF_inhal	ref	EPA Weight of Evidence	Is Constituent Carcinogenic ?
1634-04-4	Methyl t-Butyl Ether	5.00E-03	R	8.57E-01	R	-		-			FALSE

Site Name: 0 Site Location: 0 Completed By: Pacific Date Completed: 1/1/1904

RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level MCL (mg/L)	reference	Permissible Exposure Limit PEL/TLV (mg/m3)	ref	Relative Absorption Factors Oral	Dermal	Detection Limits Groundwater (mg/L)	ref	Soil (mg/kg)	ref	Half Life (First-Order Decay) (days) Saturated	Unsaturated	ref
1634-04-4	Methyl t-Butyl Ether			1.44E+02	ACGIH	1	0.5					360	180	H

Site Name: 0 Site Location: 0 Completed By: Pacific Date Completed: 1/1/1904

CAS Number	Constituent	Molecular Weight (g/mole) MW	ref	Diffusion Coefficients in air (cm2/s) Dair	ref	in water (cm2/s) Dwat	ref	log (Koc) or log(Kd) (@ 20 - 25 C) log(l/kg)	ref	Henry's Law Constant (@ 20 - 25 C) (atm-m3/mol)	(unitless)	ref	Vapor Pressure (@ 20 - 25 C) (mm Hg)	ref	Solubility (@ 20 - 25 C) (mg/L)	ref	acid pKa	base pKb	ref

Ref	Description
R	EPA Region III Risk Based Concentration Table, EPA Region 3, March 7, 1995.
S	USEPA, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, OSWER, November 1986.
H	Howard, Handbook of Environmental Degradation Rates, Lewis Publishers, Chelsea, MI, 1989
A	Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, ASTM, ES 38-94.
3	based on Kow from (2) and DiToro, D. M., 1985:"A Particle Interaction Model of Reversible Organic Chemical Sorption", Chemosphere, 14(
4	USEPA, 1989: Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) - USEPA, OAQPS, Air Emission Models, (EPA-450/3-
5	Verschueren, Karel, 1983: Handbook of Environmental data on organic Chemicals, Second Ed., (Van nostrand Reinhold Company Inc., Ne
6	Calculated diffusivity using the method of Fuller, Schettler, and Giddings from (9).
7	Calculated diffusivity using the method of Hayduk and Laudie and the reference from (9).
8	Calculated using Kenaga ang Goring Kow/solubility regression equation reference (9) and Kow data from (2), log(S, mg/l) = -0.922 log(Ko
9	Handbook of Chemical Property Estimation Methods, 1982, W.J. Lyman, (McGraw-Hill, New York), ISBN -0-07-039175-0.
10	Calculated from (Pv/Patm)/(solubility/mol wt).
11	Back calculated from solubility, Note (8) and (3).
12	Aldrich Chemical Catalog, 1991.
13	Calculated using Modified Watson Correlation from (9) and normal boiling point.
14	USEPA, 1979: Water Related Environmental Fate of 129 Priority Pollutants, Vol.1, USEPA, OWQPS,(EPA-440-79-029a).
15	The Agrochemicals Handbook, (The Royal Society of Chemistry, The University, Nottingham, England), ISBN 0-85186-406-6.
16	Vapor pressure specified at elevated temperature, adjustments to 25C using methods presented by (9).
17	Wauchope, R. D., T. M. Butler, A. G. Hornsby, P. W. M. Augustijn-Beckers, and J.P. Burt, 1992: "The SCS/ARS/CES Pesticide Properties D
18	Farm Chemicals Handbook 91, C. Sine, ed., (Meister Publishing Company, Willoughby, Ohio).
19	Structure and Nomenclature Search System, (Version 7.00/7.03) December, 1992.
20	From Syracuse Research Corporation Calculated Value from pcchem-pcgems, 1988, ref no. 255435 in Enirofate database, Accession no. 105
23	NIOSH, 1990: Pocket Guide to Chemical Hazards, (U. S. Dept. of Health & Human Services, Public Health Service, Centers for Disease Co
24	Buchter, B. et al., 1989: Correlation of Greundlich Kd and N retention Parameters with Soils and Elements, Soil Science, 148, 370-379.
25	USEPA, 1993: Air/Superfund National Technical Guidance Study series: Estimation of Air Impacts for Thermal Desorption Units Used at NTIS Accession No. PB93-215630, April 1993.
27	Based on salt solubilities in Table 3-120, R. H. Perry and D. W. Green, " Perry's Chemical Engineering Handbook" Sixth Edition, (McGraw-
28	Based on salt solubilities in Table of Physical Constants for Inorganic Compounds, Weast, R. C., CRC Handbook of Chemistry and Physics
29	Montgomery and Welkom, "Groundwater Chemicals Desk Reference", Lewis Publishers, Chelsea, MI, 1990.

CAS Number	Constituent	Reference Dose (mg/kg/day) Oral RfD_oral	ref	Inhalation RfD_inhal	ref	Slope Factors 1/(mg/kg/day) Oral SF_oral	ref	Inhalation SF_inhal	ref	EPA Weight of Evidence	Is Constituent Carcinogenic ?

0), 1505-1538. log(Koc) = 0.00028 + 0.983 log(Kow)
7-026).
York), ISBN: 0-442-28802-6.

w) + 4.184

tabase for Environmental Decision Making", Reviews of Environmental Contamination and Toxicology, vol 123, 1-155.

43.
trol, National Institute for Occupational Safety and Health).

uperfund Sites, US Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-451/R-93-005,

ill, New York), 1973.
67th edition, (CRC Press, Inc., Boca Raton), 1987.

Figure 1
Benzene Concentrations at Cross Section A-A' Over Time

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

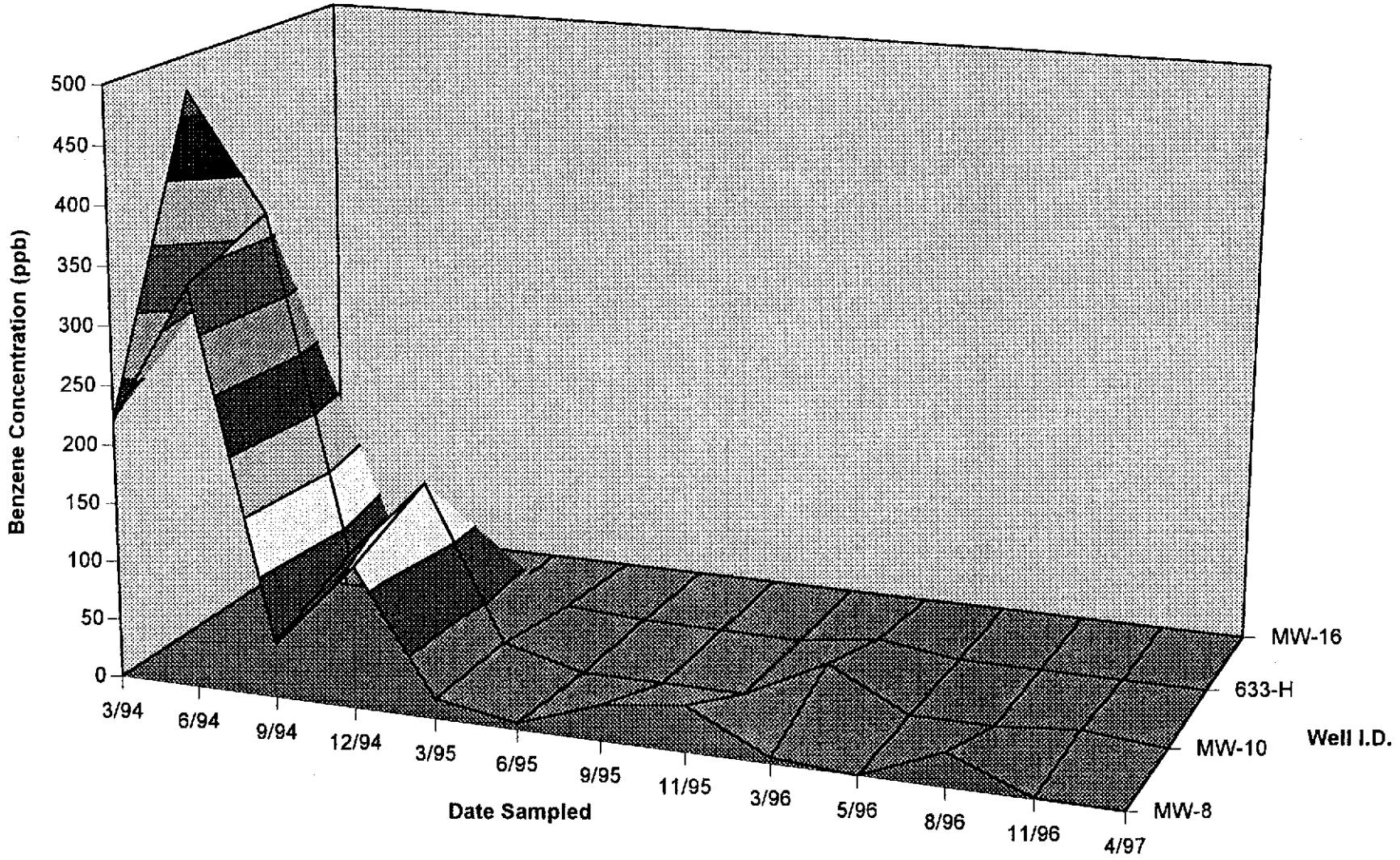


Figure 2
Mathematical Average of Benzene Concentrations at Cross-Section A'A'

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

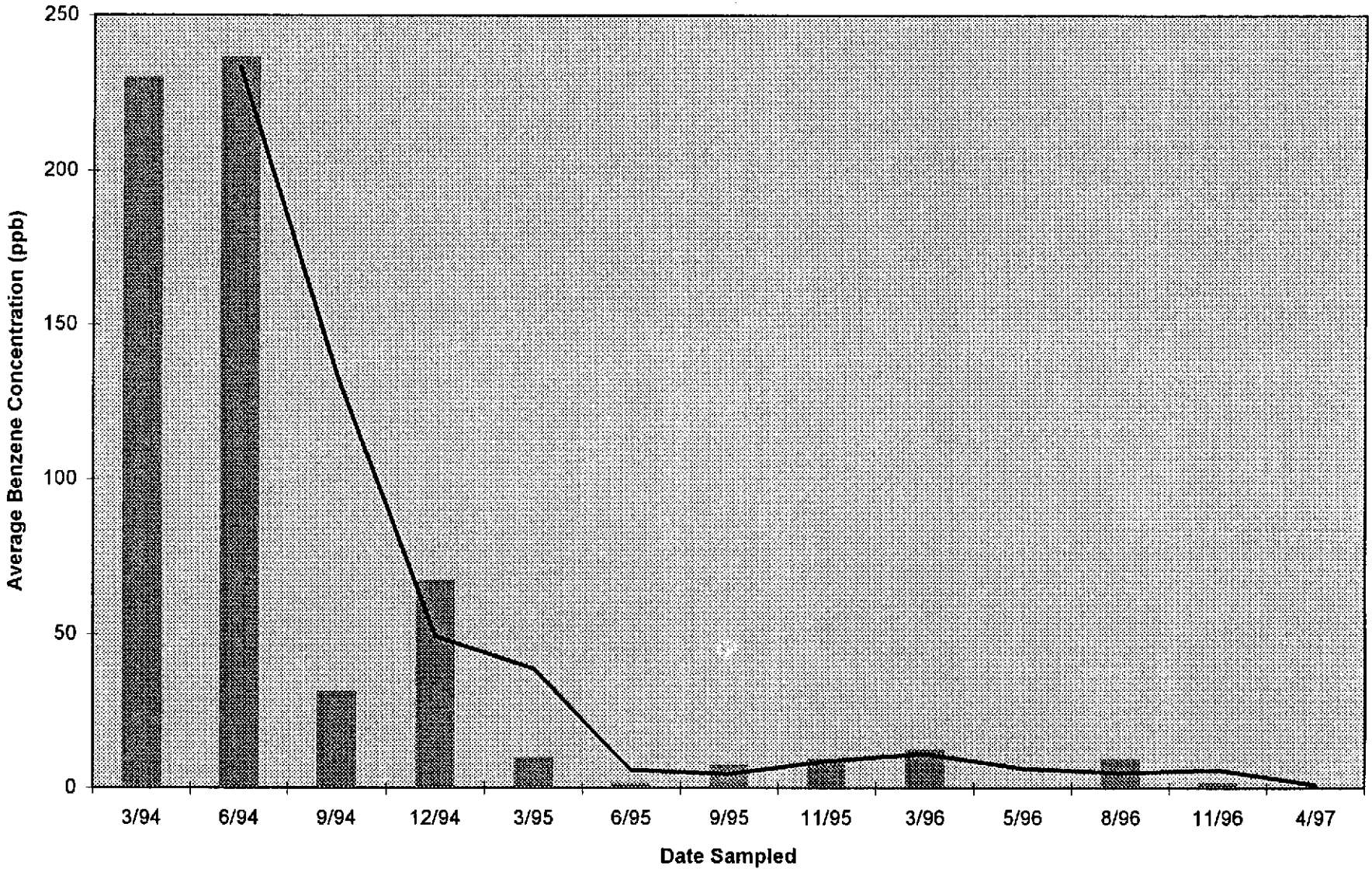


Figure 3
TPPH-Gasoline Concentrations at Cross Section A-A' Over Time

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

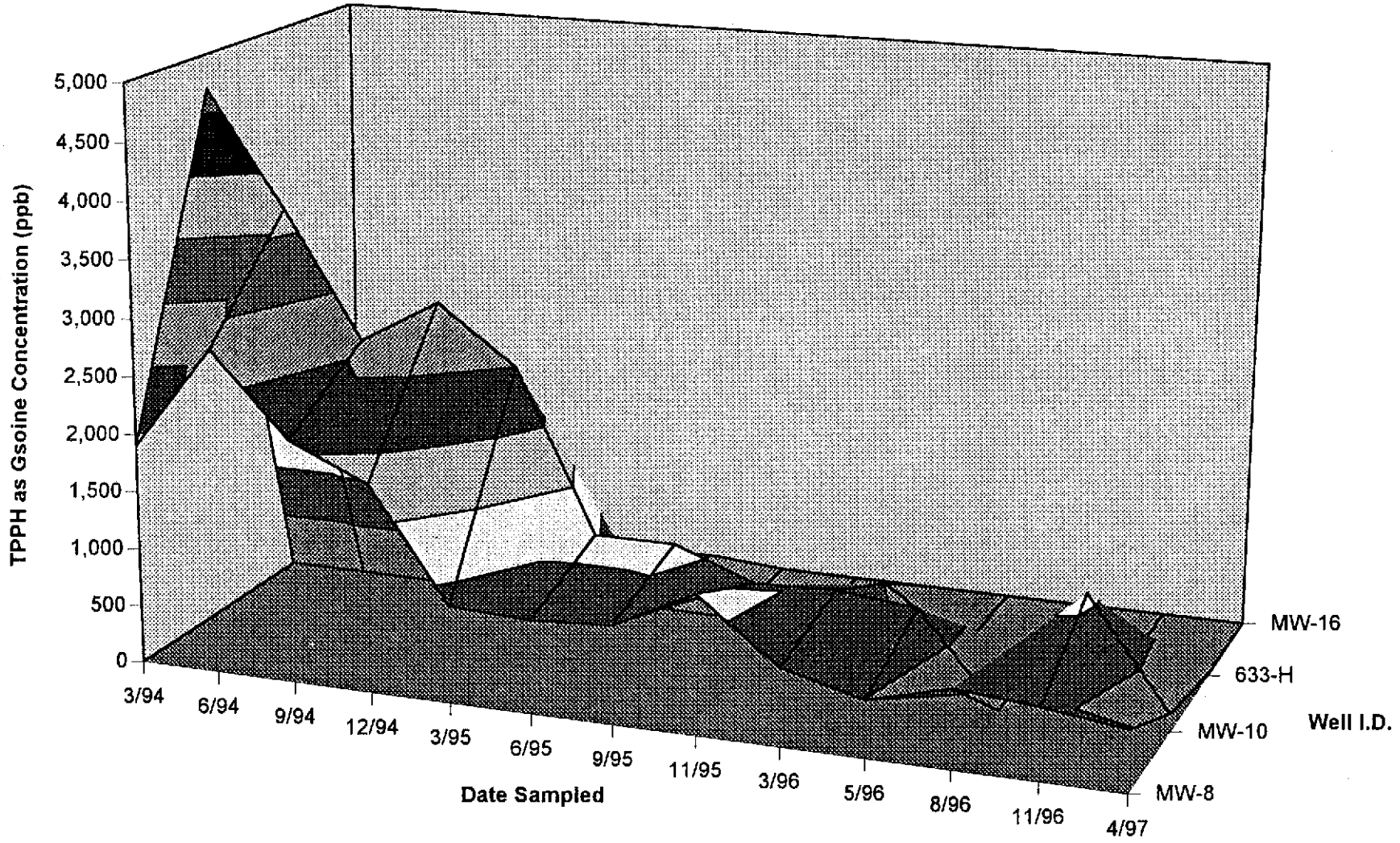
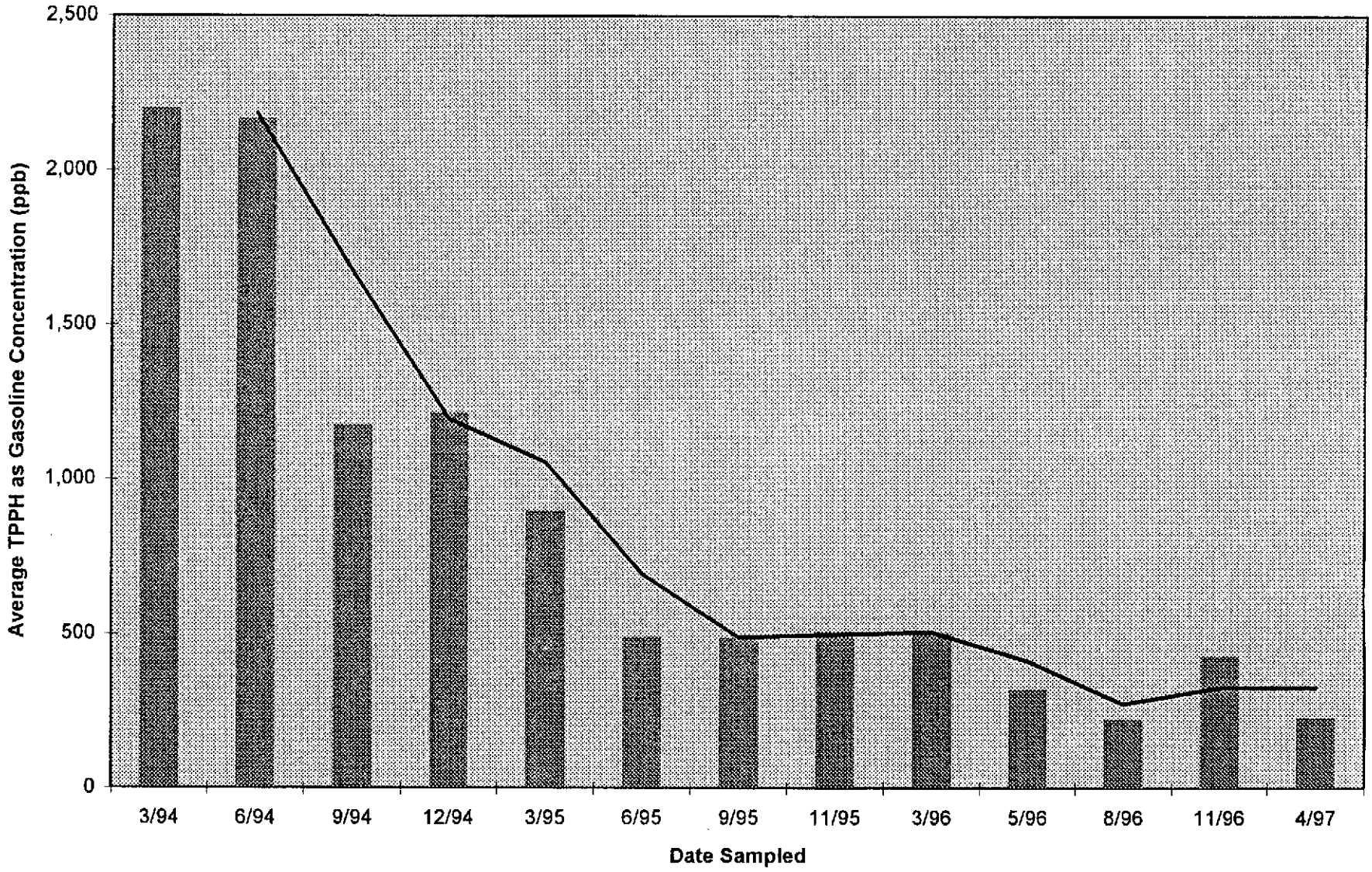


Figure 4
Mathematical Average of TPPH-Gasoline Concentrations at Cross-Section A'A'

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California



Proposed

Table 1
Groundwater Sampling Schedule

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

Well Number	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Sampling Frequency
MW-5	a	a	a	a	Quarterly
MW-7	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-8	a	a	a	a	Quarterly
MW-9	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-10	a	a	a	a	Quarterly
MW-11	a	a	a	a	Semi-~~Quarterly~~ annual
E-1A	a	a	a	a	Quarterly
MW-13	a	~~a~~	a	~~a~~	Semi-Quarterly
MW-14	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-15	a	a	a	a	Quarterly
MW-16	a	a	a	a	Quarterly
MW-17	Destroyed				
MW-18	a	~~a~~	a	~~a~~	Semi-Quarterly
MW-19	a	~~a~~	a	~~a~~	Semi-Quarterly
MW-20	Destroyed				
MW-21	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-22	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-23	a	~~a~~	a	~~a~~	Semi-Quarterly
MW-24	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-25	a	~~a~~	~~a~~	~~a~~	Annual ~~Quarterly~~
MW-26	a	~~a~~	a	~~a~~	Semi-Quarterly